

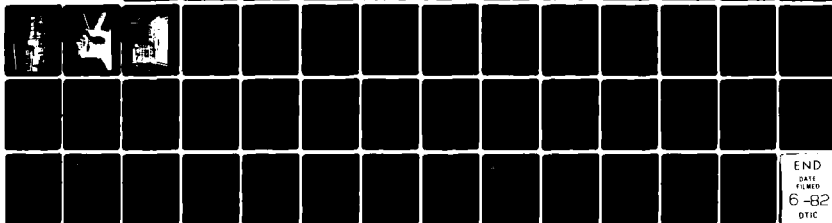
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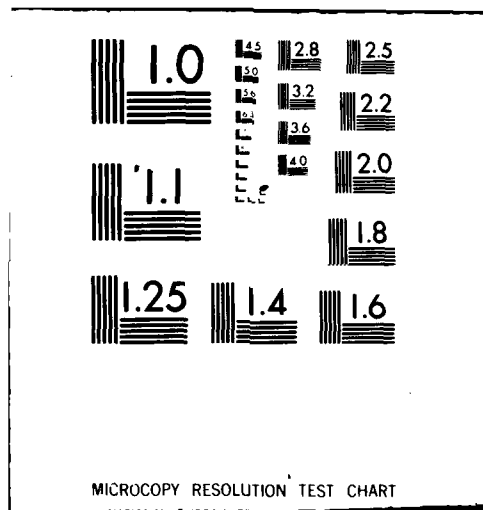
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BY THE U.S. GENERAL ACCOUNTING OFFICE

## Report To The Secretary Of Defense

### DOD Can Save Millions By Using Energy Efficient Centralized Aircraft Support Systems

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The Department of Defense can save millions of dollars annually by using new energy efficient centralized aircraft support systems at certain Air Force and Navy bases.

The Air Force and Navy have developed and installed several different systems and have realized some degree of success. However, each service has developed its systems independently. Consequently, there is no commonality between the services' systems which could permit economical procurements for standard servicewide systems. Standardization would also prevent duplication of design efforts by the services and minimize proliferation of aircraft support equipment. It also would allow the services to further reduce costs by combining requirements to assure the most economical quantities for buying system components.

GAO makes specific recommendations to the Secretaries of Defense and the Air Force to develop standard systems and to install them at all bases where feasible and practical. ↙

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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,  
AND READINESS DIVISION

B-206216

The Honorable Caspar W. Weinberger  
The Secretary of Defense

Attention: Director, GAO Affairs

Dear Mr. Secretary:

This report discusses how Defense can save millions of dollars by using energy efficient centralized aircraft support systems.

We made our review as part of our continuing effort to evaluate the services' systems for providing aircraft ground support.

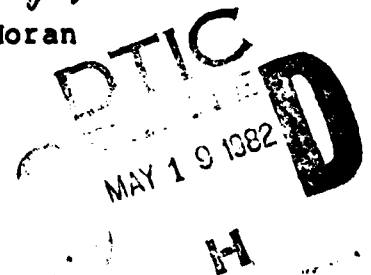
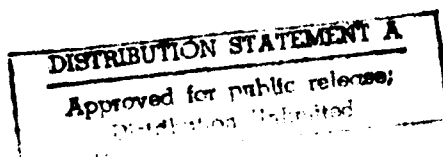
This report contains recommendations to you on page 19. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the Director, Office of Management and Budget; the Chairmen, House Committee on Government Operations, Senate Committee on Governmental Affairs, and House and Senate Committees on Appropriations and on Armed Services; and the Secretaries of the Navy and Air Force.

Sincerely yours,

*Donald J. Horan*

Donald J. Horan  
Director



GENERAL ACCOUNTING OFFICE  
REPORT TO THE SECRETARY  
OF DEFENSE

DOD CAN SAVE MILLIONS BY USING  
ENERGY EFFICIENT CENTRALIZED  
AIRCRAFT SUPPORT SYSTEMS

D I G E S T

GAO has reviewed Air Force and Navy use of centralized aircraft support systems. It found that these systems can save millions of dollars and significantly reduce fuel consumption.

In a prior report, GAO disclosed that increased standardization would reduce the costs of ground support equipment for military aircraft. Each new aircraft developed for the military services causes the development of thousands of ground support equipment items costing hundreds of millions of dollars. Much of this new equipment performs the same function as equipment already in service.

GAO also reported that the Air Force and Navy spend more than \$1.2 billion annually for this equipment, which is used for ground servicing and maintenance. The estimated value of such equipment already in Air Force and Navy inventories is \$13 billion.

GAO concluded that substantial savings could be realized in research and development, procurement, and logistics costs if ground support equipment could service more than one type of aircraft. Commercial airlines, although they operate in a different environment from the services, stress standardization to such a degree that most of their support equipment can be used for more than one airplane. Accordingly, commercial airlines are implementing centralized systems rapidly. (See p. 10.)

GAO made this review to evaluate the actions taken by the Air Force and Navy to use standardized centralized aircraft support systems in lieu of mobile equipment to provide air and electrical power to support aircraft while on the ground.

The Department of Defense can save millions of dollars annually by using new energy efficient centralized systems at certain Air Force and Navy bases. For example, the Air Force Training Command estimates annual savings of \$5.2 million by using the systems at its seven bases. In addition, the services could reduce their consumption of fuel now being used to operate mobile ground support equipment by millions of gallons, if the systems were used.

The Air Force and Navy use two methods to provide aircraft ground support services. The primary method uses mobile, fuel-powered equipment, which must be towed to the aircraft. The other is a centralized system, powered from a single source, to provide fixed-point services to the aircraft on the parking apron.

The services spend millions of dollars annually to procure, operate, and maintain the mobile equipment. They use millions of gallons of fuel to start and maintain the aircraft while on the ground. These costs, and the related fuel consumption, can be reduced significantly by using a centralized system. (See p. 2.)

The Air Force and Navy have developed and installed several different centralized systems. Both have realized some degree of success. However, each service has developed its centralized systems independently. Consequently, there is no commonality between the services' systems which could permit economical procurements. Standardization would also prevent duplication of design efforts by the services and minimize proliferation of aircraft support equipment. It also would allow the services to further reduce costs by combining requirements to assure the most economical quantities for buying system components. (See p. 2.)

The Navy's systems are not as fuel efficient as the Air Force's because they generally use fuel-consuming equipment to generate their power. The Air Force's system is a newer design powered by commercial electricity. It is highly efficient and economical, thereby resulting in significant savings in personnel, maintenance, and fuel costs.

While the main benefits of centralized systems are the dollars saved and fuel conserved, there are other benefits. Not so quantifiable are the benefits from reduced vehicle traffic on the parking apron, reduced mobile equipment exhaust heat, reduced noise and air pollution, fewer personnel needed to move the equipment, reduced time for maintenance personnel awaiting mobile equipment, less chance for engine damage from foreign objects, and less possibility of damaging parked aircraft in moving mobile equipment. (See p. 10.)

Despite the millions of dollars that can be saved from using the centralized system, neither the Air Force nor the Navy has fully implemented the system. The Air Training Command has the Air Force's only fully

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operational system at Randolph Air Force Base, Texas. The Command estimates that this system saved about \$769,200--mostly fuel--during fiscal year 1981. Accordingly, the Command plans to install systems at its other 6 bases, and the Strategic Air Command plans to install them at 21 of its bases.

The Navy has a number of older systems in operation and it has been working independently of the Air Force to develop a new centralized system. Moreover, the Navy now plans to incorporate the Air Force's rotary compressor into its system and to install the system at naval air stations where cost effective. (See p. 11.)

Substantial savings also can be realized by installing the centralized systems concurrently with major construction projects for aircraft parking aprons and underground refueling systems. Centralized systems use underground lateral networks to transport power from the base station to aircraft servicing points on the parking apron, thus requiring extensive trenching of the parking apron. Coordinating the installation of the systems with these construction projects would eliminate the trenching costs. (See p. 17.)

Requirements for mobile equipment will be reduced as the centralized systems are installed. For example, the Air Force Training Command estimates that it will save an additional \$8.4 million by installing the systems at all of its bases, thereby eliminating the need to replace its aged mobile equipment. Further, a March 1979 Navy report estimated savings of \$28.4 million if systems are installed at 11 of its air stations. Accordingly, adjustments will have to be made to planned procurements of over \$500 million of mobile equipment. (See p. 18.)

The Air Force recognizes that its system is cost effective and plans to install the system at many of its bases. However, it does not plan to install its systems at any of its tactical bases because these units must be able to deploy worldwide with their mobile equipment, and they need trained personnel to maintain it. Also, a new generator set is being acquired which the Air Force says will significantly reduce fuel consumption. (See p. 24.)

While these concerns are valid, GAO believes that with proper planning and realignment of operating procedures, tactical bases can use centralized systems to support most of their daily operations,

maintain their mobile equipment, and have trained personnel for deployment. At the same time fuel consumption can be reduced significantly and millions of dollars can be saved. (See p 24.)

#### RECOMMENDATIONS

GAO recommends that the Secretary of Defense direct the Secretaries of the Air Force and the Navy to:

- Develop a plan for installing centralized systems at those air bases where they can be used cost effectively without adversely affecting mission capabilities.
- Give first priority to installing systems in conjunction with major aircraft parking apron renovations and underground refueling systems. (See app. VII.)
- Give the next priority to those bases that do not need mobile equipment for deployment (e.g., certain Strategic Air Command units and Navy units deploying to aircraft carriers).
- Coordinate the development of standard centralized systems consistent with operational and mission requirements and insure that all systems acquired are procured using design specifications based on a standard system or systems.
- Combine requirements to assure the most economical quantities for buying system components.
- Closely coordinate and monitor these procurements with planned procurements for mobile equipment to assure that appropriate adjustments are made to reduce or delay the latter procurements where applicable. (See p. 20.)

GAO also recommends that the Secretary of the Air Force:

- Reevaluate the decision not to install centralized systems at tactical bases. If the systems can be used at these bases without adversely affecting the units' deployment missions, first priority should be given to installing the systems at tactical bases undergoing parking apron renovations, as shown in appendix VII.
- Assess the requirement for the new generator set, along with other mobile equipment, as recommended above. (See p. 24.)



AGENCY COMMENTS AND  
GAO'S EVALUATION

Defense generally agreed with the draft report and its recommendations. (See app. VIII.) Accordingly, Defense recognizes the significant savings in fuel, personnel, and equipment. As a result, the services have initiated actions to implement centralized systems at those installations where economies can be achieved without jeopardizing operational and readiness requirements. (See p. 20.)

Although in general agreement, Defense expressed reservations about the recommendations dealing with base prioritization for system implementation and standardization. Defense stated that GAO should delete the specific reference to training bases because many variables influence prioritization for system installations and other options may be preferable in some cases. GAO agreed and has revised the recommendation accordingly. (See p. 20.)

Defense also stated that caution must be exercised to insure that system standardization is compatible with the diverse operating environments and the units using the equipment. Therefore, Defense will monitor service efforts to insure the maximum degree of standardization consistent with operational and mission requirements. GAO agreed and clarified the recommendation. (See p. 20.)

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## CHAPTER 1

### INTRODUCTION

The Air Force and Navy spend millions of dollars annually to procure, operate, and maintain mobile equipment to support aircraft. This mobile equipment uses fuel to generate the air and electrical power necessary to start and maintain aircraft while on the ground. The equipment consists of electric generators, jet engine starting units, tow vehicles, and other units which provide specialized aircraft services.

On February 7, 1980, we reported <sup>1/</sup> that increased standardization would reduce the costs of ground support equipment for military aircraft. Each new aircraft developed for the military services causes the development of thousands of ground support equipment items costing hundreds of millions of dollars. Much of this new equipment performs the same function as equipment already in service.

Our report also showed that the Air Force and Navy spent more than \$1.2 billion annually for ground service and maintenance equipment. The estimated value of such equipment already in Air Force and Navy inventories was \$13 billion.

We concluded that substantial savings could be realized in research and development, procurement, and logistics costs if ground support equipment could service more than one type of aircraft. Commercial airlines, although they operate in a different environment from the services, stress standardization to such a degree that most of their support equipment can be used for more than one airplane.

### METHODS OF PROVIDING AIRCRAFT GROUND SUPPORT

The Air Force and Navy use mobile equipment or centralized systems to provide aircraft ground support. The mobile equipment consumes fuel and must be towed to the aircraft needing service. The centralized system derives its power from a single electrical source and provides fixed-point services to aircraft on a parking apron.

Both services use the mobile equipment as their primary source of providing aircraft ground support. However, a few centralized systems have been installed. Increased use and standardization of centralized systems can save millions of dollars in the procurement, operation, and maintenance of equipment, while conserving millions of gallons of fuel.

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<sup>1/</sup>"Increased Standardization Would Reduce Costs of Ground Support Equipment For Military Aircraft" (LCD-80-30).

### Mobile ground support equipment

The Air Force and Navy primarily use mobile, fuel-powered equipment to support their aircraft. This equipment is highly fuel inefficient compared to centralized systems. In the Navy, some of the mobile equipment is self-propelled; however, both services maintain tow tractors solely to transport mobile equipment around the flight line. The variety and quantity of mobile ground support equipment assigned to an installation are dependent on the type of aircraft supported. Appendix I identifies the types of mobile equipment used and the services provided.

### Centralized aircraft support

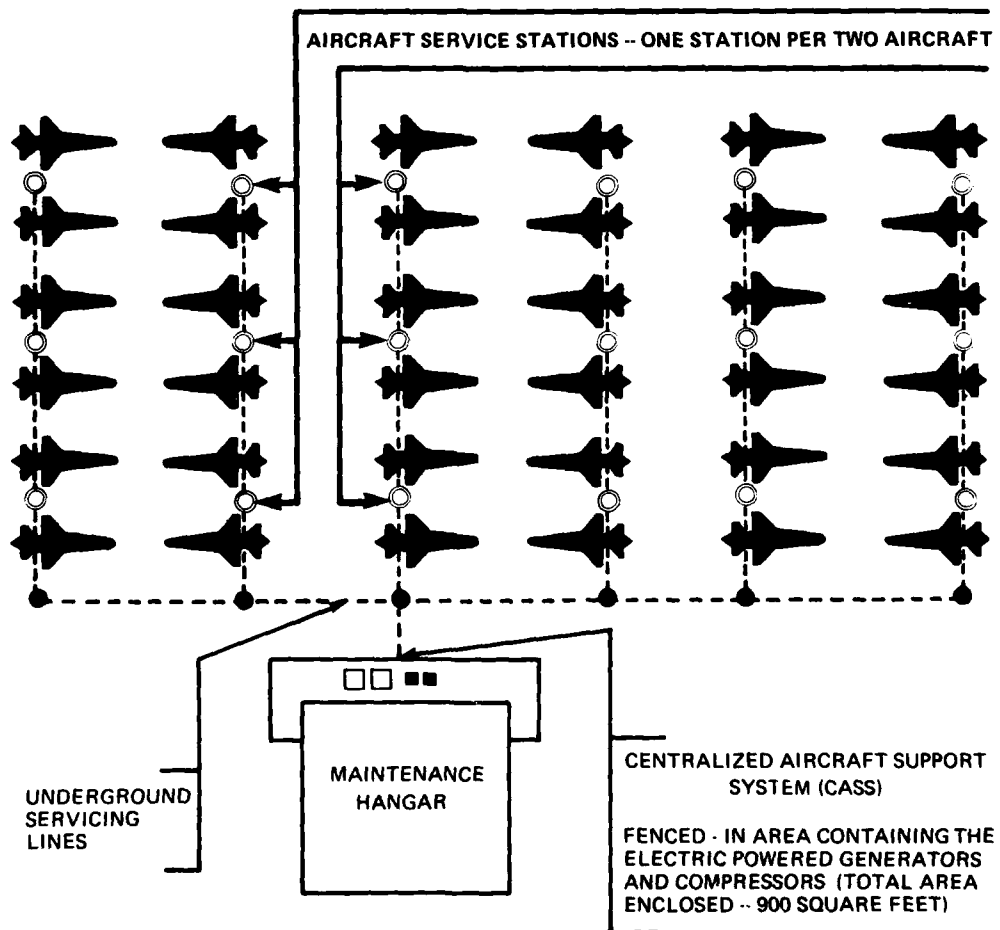
The Air Force and the Navy have installed some form of a centralized system at a limited number of bases. A centralized system generally consists of a base station, which is the central power source, and service stations on the parking apron. The power is provided by electric or motor-driven air compressors and electric generators. Ancillary equipment include electrical switching gear and air-conditioning units. The base stations provide such services as compressed air for starting jet engines and for pneumatic tool operation, air-conditioning for electronic systems, and electricity for aircraft electrical systems and for test equipment. Air and electrical power are distributed throughout the parking apron by underground conduits. The service stations access the underground lateral network and are usually installed between two aircraft. The following is a diagram of the centralized system at Randolph Air Force Base and pictures of its base station and service area.

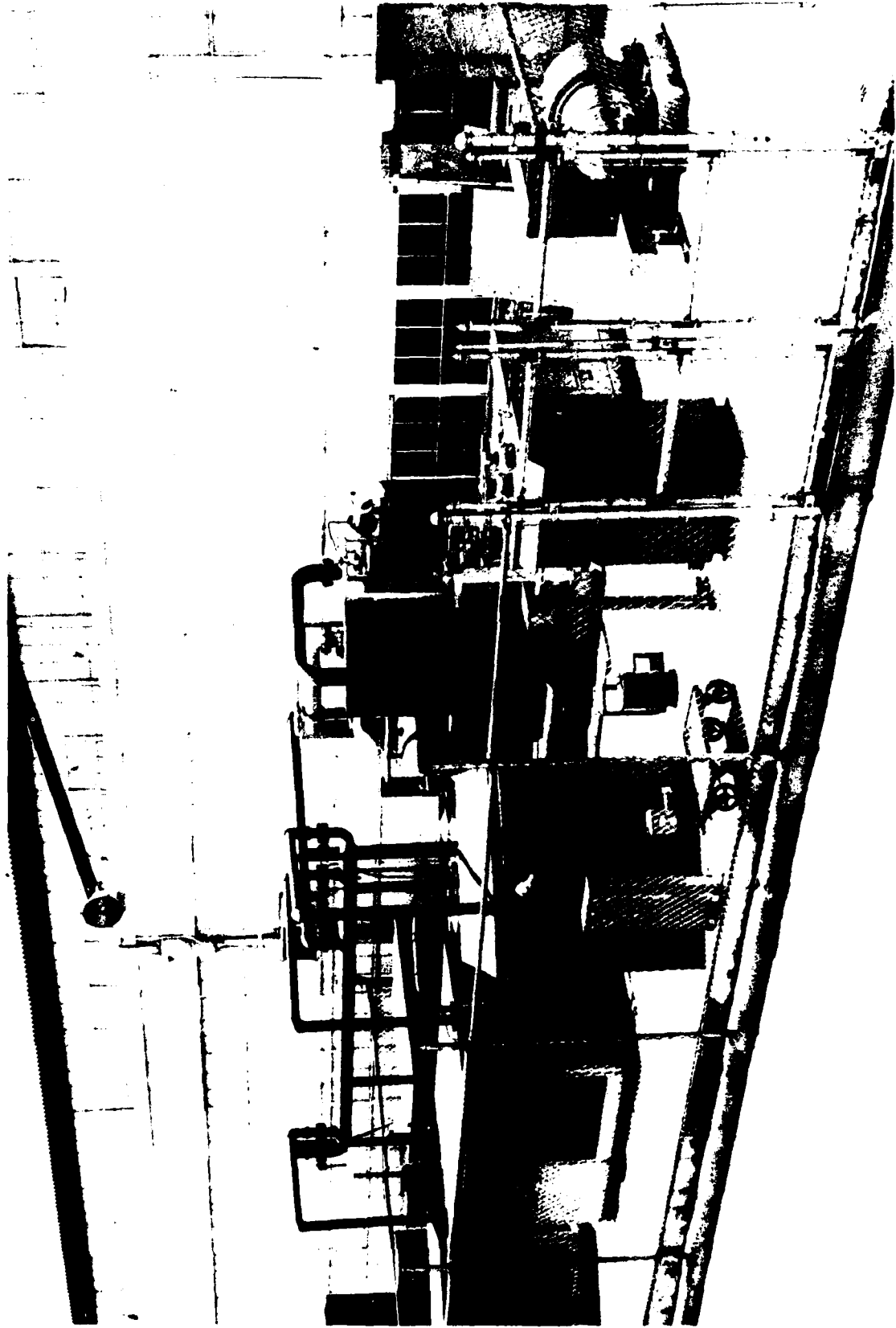
### NAVY AND AIR FORCE USE DIFFERENT CENTRALIZED SYSTEMS

The Navy has had experience with centralized systems for the past 20 years, while the Air Force has recently entered the field. Both services have demonstrated that centralized systems can reduce operating and maintenance costs and conserve fuel. The Air Force and Navy, however, developed their systems independently. Consequently, there is no commonality between the systems which could permit economical procurements for a standard servicewide system. A common system or systems would also allow the services to further reduce costs by combining requirements to assure the most economical quantities for buying system components.

The Navy developed and began using three different centralized systems in the 1960s. One system provides power for aircraft electrical systems, another system provides stored compressed air for starting jet engines, and the other system provides electric power and stored compressed air. Because these systems generally use fuel-consuming equipment to generate their power, they are not as fuel efficient as the Air Force's system.

DIAGRAM OF CENTRALIZED AIRCRAFT  
SUPPORT SYSTEM AT RANDOLPH  
AIR FORCE BASE



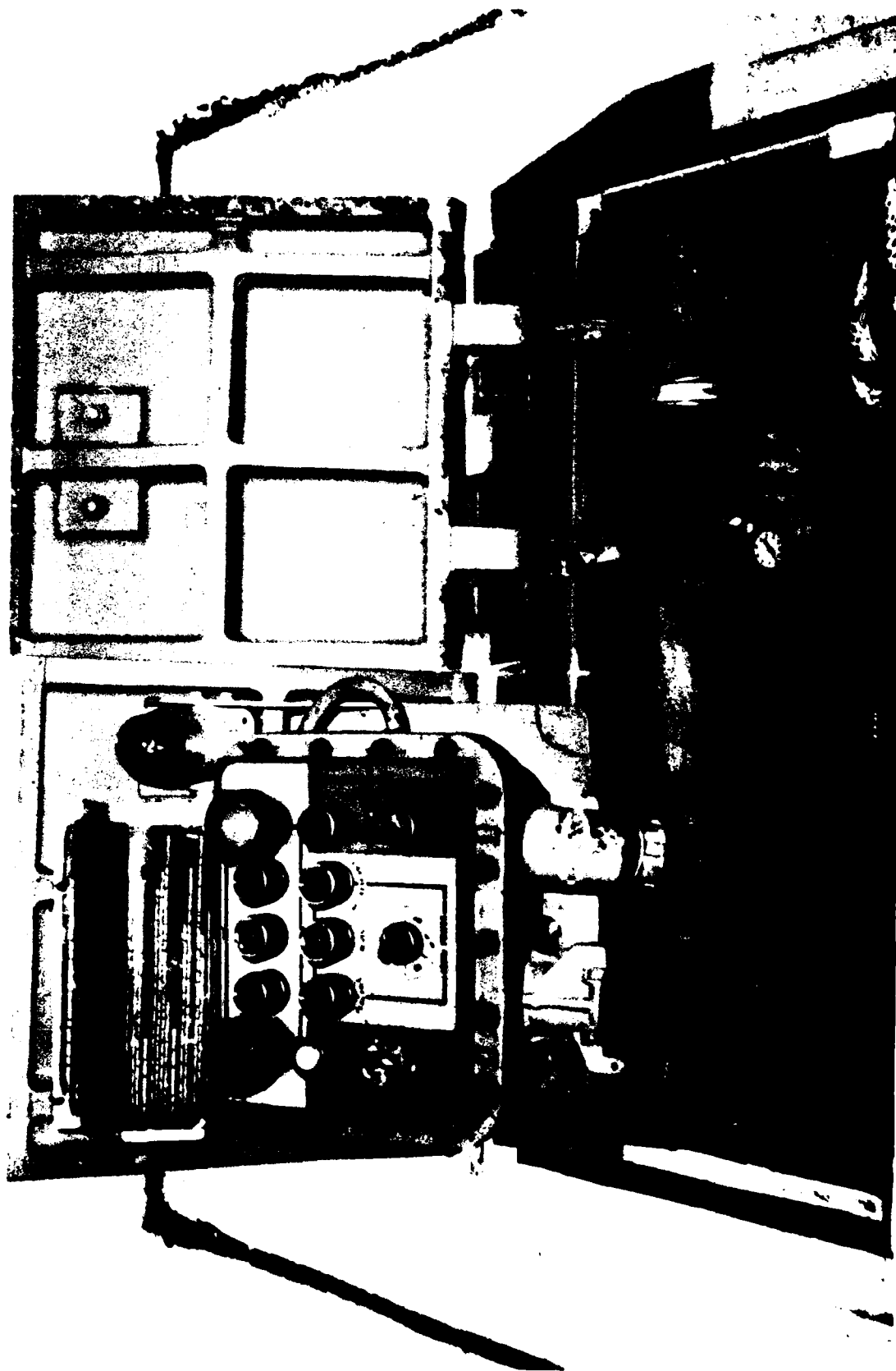


CENTRALIZED AIRCRAFT SUPPORT SYSTEM BASE STATION, RANDOLPH AIR FORCE BASE



**CENTRALIZED AIRCRAFT SUPPORT SYSTEM PARKING APRON SERVICE STATION SUPPORTS TWO AIRCRAFT  
ABOVE GROUND INSTALLATION 18 Installed at Randolph Air Force Base**





CENTRALIZED AIRCRAFT SUPPORT SYSTEM PARKING APRON SERVICE STATION SUPPORTS TWO AIRCRAFT  
BELOW GROUND INSTALLATION 18 Installed at Randolph Air Force Base

For example, the Navy's systems use a stored-air concept whereby compressed air is fed into giant storage tanks by fuel-powered, piston-driven air compressors and then supplied to the flight line for engine starting and other purposes. The problem with this system is that when the storage tanks lose pressure, the compressors must be run to restore it. In addition, once the stored air has been depleted, it takes several hours to refill the tanks. On the other hand, the Air Force's system uses a rotary compressor that provides air on demand, eliminating the need for storage tanks. Moreover, the Air Force's system is highly fuel efficient because it uses commercial electricity to power base station equipment.

The Navy designed one of its systems to start 18 aircraft simultaneously. To start this many aircraft at one time required the Navy to use a stored-air system. The Air Force's system is computer controlled to air start four aircraft simultaneously and to start other aircraft as soon as any of four aircraft are started and disconnected from the system. It also provides electrical power for 20 aircraft. These capabilities can be increased, according to Air Force officials.

The Navy also has a flight line electrical distribution system that provides electric power to service numerous aircraft simultaneously. The Air Force centralized system provides power for aircraft electrical systems and electric household current to operate test equipment and lights. About 50 percent of the Navy's electrical distribution systems are powered by internal combustion engines, whereas the Air Force's system uses a less expensive electric generator powered by commercial electricity.

The Navy has made various studies identifying the benefits of using centralized systems, and it is continuing efforts to identify a specific system or systems for use at selected installations.

#### OBJECTIVES, SCOPE, AND METHODOLOGY

We made this review to identify the potential savings available through the use of highly fuel-efficient centralized systems to replace or reduce the use of fuel inefficient mobile ground support equipment. We believe that centralized systems have the potential for large annual savings in operation and maintenance costs if installed at all applicable Air Force and Navy bases.

We have demonstrated the potential savings through a detailed evaluation of the centralize system in operation at Randolph Air Force Base, Texas, and our evaluations of the system's applicability and benefits at other Air Force and Navy bases. However, the cost effectiveness of using a centralized system at any given air base will have to be determined by (1) an analysis of the installation cost and (2) the overall cost reduction in providing aircraft ground support services to the particular types of aircraft at the base. Specifically, our objectives were to determine

- services efforts to install new energy efficient centralized systems,
- the extent of coordination between and within the Air Force and Navy to accept and standardize the systems, and
- the planned procurement of mobile aircraft ground support equipment after the installation of the centralized systems.

We limited our review to selected Air Force and Navy commands with various types of aircraft, ground support requirements, and mission objectives. We visited the following Air Force commands and bases:

- Air Training Command, Randolph Air Force Base, Texas
- Strategic Air Command, Offutt Air Force Base, Nebraska
- Barksdale Air Force Base, Louisiana
- Military Airlift Command, Scott Air Force Base, Illinois
- Little Rock Air Force Base, Arkansas
- Tactical Air Command, Langley Air Force Base, Virginia
- Bergstrom Air Force Base, Texas
- Headquarters, U.S. Air Forces in Europe, Ramstein Air Base, Germany
- Bitburg Air Base, Germany
- Torrejon and Zaragoza Air Bases, Spain

Navy commands and bases visited included the Naval Air Training Command, Naval Air Station, Beeville, Texas, and the Naval Air Command Atlantic Fleet, Naval Air Station, Oceana, Virginia. Additionally, we either visited or contacted the Air Force Air Logistics Centers and the Naval Supply Centers responsible for procuring aircraft mobile ground support equipment. We also visited or contacted officials in the Departments of the Air Force and the Navy.

We did not include the Army in our review because the cost to operate and maintain similar mobile ground support equipment for Army aircraft is minimal. Also, the scope of our review did not include Air Force and Navy Reserve units' aircraft which require ground support services similar to those found in active Air Force and Navy units. Further, we made no effort to determine

the impact that servicewide centralized systems would have on either depot overhaul activities or the stocking and procuring of spare parts in support of mobile ground support equipment.

We interviewed Air Force and Navy officials in Washington and at the major commands to determine the feasibility of installing centralized systems at selected bases. Copies of base studies, documenting the feasibility of centralized systems, were obtained, analyzed, and evaluated. In the absence of formal feasibility studies, we obtained officials' comments concerning the installation of centralized systems. We contacted officials at Air Force and Navy procurement centers to obtain current worldwide status of selected mobile ground support equipment and data addressing future procurement actions.

We reviewed studies and reports in the Air Force and Navy that addressed the management, operation, and maintenance costs of using centralized systems instead of mobile ground equipment. Air Force documentation consisted primarily of various studies and reports concerning its Air Training Command's involvement in planning and implementing centralized systems at its seven bases.

We interviewed officials at each installation visited to determine whether centralized systems could be adapted to support various aircraft with differing ground support demands and mission requirements. We also obtained base financial data identifying personnel, operation, and maintenance costs to provide aircraft ground support using mobile equipment with particular emphasis on fuel costs.

Each proposed centralized system was tailored both to the aircraft supported and to the mission of the unit. Data gathered at each major command was analyzed to identify like bases within the command in terms of type and number of aircraft supported and total operational costs to support those aircraft with mobile equipment.

Estimated procurement and installation costs for the centralized systems at each base visited were predicated on the costs associated with the system in the Air Training Command and on data obtained from Navy studies. However, accurate procurement and installation costs will be obtainable only through detailed engineering analysis at each base. Estimated savings achievable by adopting the centralized systems at each base were obtained through documented studies and the estimates of knowledgeable Air Force and Navy officials.

## CHAPTER 2

### POTENTIAL SAVINGS BY USING FUEL EFFICIENT

#### CENTRALIZED AIRCRAFT SUPPORT SYSTEMS

Millions of dollars can be saved annually by using centralized aircraft support systems at Air Force and Navy air bases. These savings include millions of gallons of fuel, which are now being used to operate mobile ground support equipment.

The centralized systems have proven their ability to support both civilian and military aircraft. However, despite their efficiency and effectiveness and the millions of dollars that can be saved, only a few bases have installed these systems. Moreover, some commands do not plan to install them, while others plan to install them at only a few bases. Furthermore, timely installation of centralized systems at bases undertaking parking apron renovation and repair projects or underground refueling projects would reduce the construction costs for installing the systems.

#### BENEFITS OF CENTRALIZED SYSTEMS

The main benefits are the dollars saved and the fuel conserved, but there are other benefits. Not so quantifiable are the benefits from reduced vehicle traffic on the parking apron, reduced mobile equipment exhaust heat, reduced noise and air pollution, fewer personnel needed to move the equipment, reduced time for maintenance personnel awaiting mobile equipment, reduced equipment maintenance, less chance for foreign object damage by ingesting parts into jet engines, and less possibility of damaging parked aircraft in moving mobile equipment.

#### Commercial airlines' use of centralized systems

The Air Transport Association estimates that installing centralized systems at all airports, where feasible, could conserve about 500 million gallons of jet fuel annually. As of December 1980, 47 centralized electrical support systems were installed at 26 airports serving about 500 gates. As of February 1981, 188 additional gates were converted. Estimates indicate that over 20 million gallons of fuel were conserved last year just by centralizing electrical support systems.

Complete centralized systems which will provide not only the electrical support but all the low pressure air required for starting engines and for aircraft environmental systems are being considered. Adopting a centralized air source and electrical system will enable airlines to discontinue using the aircraft's onboard auxillary power units. These units consume tremendous amounts of jet fuel in providing cabin air-conditioning and starting power while the aircraft is on the ground. It is estimated that annually 800 million gallons of jet fuel are burned by the auxillary power units on board all U.S. commercial aircraft.

The cost effectiveness of a centralized system is evidenced by the airlines reported payback periods of 1 year or less. Other benefits have also influenced major carriers to adopt and implement the centralized systems. Electric, motor-driven air compressors and generators are less complicated and costly to maintain than those that are engine-driven. The operating costs are lower because the system is demand controlled--engines are not running when there is no demand.

Airline Transport Association officials stated that the centralized systems have improved working conditions and lessened fatigue among the maintenance personnel who are responsible for providing the ground support services to the aircraft. Reports indicate that the trade-off in capital investment costs is favorable when comparing the procurement cost of the centralized system to the procurement cost of mobile equipment.

These officials also stated that the governing factor which precipitated the airlines rapid conversion was the oil embargo of 1973. Not only was the availability of jet fuel an overriding concern but the increasing cost of jet fuel cut deeply into the profits of most airlines. Today, with the strong emphasis on the conversion to both air and electrical centralized systems, the airlines can reduce costs and conserve jet fuel.

#### Services could benefit from implementing centralized systems

Despite the millions that can be saved from using centralized systems, neither the Air Force nor the Navy has fully implemented the systems. The Air Training Command has the Air Force's only fully operational centralized system at Randolph Air Force Base. The Command estimates that this system saved \$769,200 during fiscal year 1981. Accordingly, the Command plans to install centralized systems at its other 6 bases, and the Strategic Air Command plans to install them at 21 of its bases.

Other Air Force commands continue to raise objections to using the centralized systems. Some of the objections have merit, but with proper planning and realignment of operating procedures, we believe that most concerns can be overcome. (See ch. 3 for a discussion of these concerns and possible solutions.)

Between 1959 and 1976, the Navy procured 98 centralized systems which provide only jet engine starting air. However, because of the age of some of the systems, poor design, and shortage of spare parts, only 18 are currently operating. The Navy has procured about 42 other systems that provide electric power. The Navy also installed centralized systems that provide both jet engine starting air and electrical power at five bases.

The Navy has been working independently to develop a new system. However, it now plans to incorporate the Air Force's

rotary compressor in its system at naval air stations where cost effective.

Air Training Command plans  
commandwide use of system

The Air Training Command projected a 25-year savings of \$139 million from using centralized systems to support about 700 T-38 aircraft at its seven bases. The Command calculated the payback period to be less than 3.6 years. The following table illustrates the Command's estimate of annual savings attainable by using its centralized system instead of mobile ground support equipment.

<u>Type of</u> <u>system</u>	<u>Personnel</u>	<u>Mainte-</u> <u>nance</u>	<u>Fuel</u>	<u>Total</u>
	------(000 omitted)-----			
Mobile	\$1,994	\$1,068	\$2,913	\$5,975
Centralized	<u>480</u>	<u>151</u>	<u>117</u>	<u>748</u>
Savings	<u>\$1,514</u>	<u>\$ 917</u>	<u>\$2,796</u>	<u>\$5,227</u>

Annually, the centralized systems will save 76 percent in personnel costs, 86 percent in maintenance costs, and 96 percent in fuel costs. The \$2,796,000 fuel savings represents over 2.2 million gallons of jet fuel. Not included in the table is a one-time procurement savings of \$8.4 million by buying the centralized systems instead of replacing the Command's aged mobile equipment. We evaluated these estimates and found them reasonable based on the Command's experience of operating a centralized system at Randolph Air Force Base.

The system is installed and operational at Randolph Air Force Base and is being, or scheduled to be, installed at the remaining six training bases. The Randolph system cost about \$1.7 million, and it provides most of the daily ground support for 72 T-38 aircraft. It replaced four separate types of mobile fuel-powered ground support equipment.

According to Command officials, the Randolph system cost only \$84,400 to operate during fiscal year 1981, as compared to an average cost of \$853,600 to operate the mobile equipment at each of its other six similar training bases--a difference of \$769,200. The following table gives a comparative analysis of this data during fiscal year 1981.

Type of system	<u>Personnel</u>	<u>Maintenance</u>	<u>Fuel</u>	<u>Total</u>
Mobile	\$284,900	\$152,600	\$416,100	\$853,600
Centralized	<u>57,500</u>	<u>10,000</u>	<u>16,900</u>	<u>84,400</u>
Savings	<u>\$227,400</u>	<u>\$142,600</u>	<u>\$399,200</u>	<u>\$769,200</u>
Percentage	79.8	93.4	95.9	90.1

Based on this actual operating data, savings at all seven training bases may be even higher than originally estimated, thereby reducing the payback period.

The Air Training Command sent the test results of the centralized system at Randolph to Air Force Headquarters suggesting that other major commands would benefit from installing its system. It also stated that the system will significantly improve aircraft servicing and save millions of dollars. Accordingly, the test results were sent to all major commands with a request that each command indicate its intent to install the system. The replies received varied from outright rejection of the system to interest in installing it at some bases.

#### Strategic Air Command could save millions by using centralized systems

The Strategic Air Command could save millions in annual operation and maintenance costs by using centralized systems at its bases. The Command has about 900 KC-135, B-52, and FB-111 aircraft at 30 bases. During fiscal year 1980, it spent over \$31.1 million to operate and maintain ground support equipment at these bases.

Our analysis at Barksdale Air Force Base shows that the system can effectively support KC-135 and B-52 aircraft. Command studies also show that these aircraft and the FB-111 aircraft can also be effectively supported. In fact, Command officials stated that a centralized system is feasible at any air base.

#### Strategic Air Command strongly endorses centralized systems

Strategic Air Command officials strongly support centralized systems and they have requested funds, for the second time, to install a system at Castle Air Force Base, Merced, California. Funding was not approved for the first request because of an Air Force requirement that at least 50 percent of the savings computed for a project must be in personnel costs. This requirement no longer exists, and Command officials are hopeful that funding will be approved. These officials believe that if funding can be obtained to install a system at Castle, the benefits can be



proven, and funding for the systems at other bases will become more readily available.

The Command's study for a centralized system at Castle estimates installation cost at \$9 million, with annual operation and maintenance cost savings of about \$2.2 million. Savings in fuel alone was estimated at 768,000 gallons. The payback period was estimated to be 4.2 years and the 20-year savings was estimated to be \$45 million.

Using the system at Barksdale Air Force Base would reduce costs

We reviewed the method and costs of providing mobile ground support services to the KC-135 and B-52 aircraft at Barksdale Air Force Base. These services are provided by 165 units of mobile equipment. Our analysis shows potential annual savings of about \$651,000 could be realized by using a centralized system compared to using mobile equipment.

<u>Type of system</u>	<u>Personnel</u>	<u>Maintenance</u>	<u>Fuel</u>	<u>Total</u>
----- (000 omitted) -----				
Mobile	\$886	\$188	\$727	\$1,801
Centralized	<u>800</u>	<u>132</u>	<u>218</u>	<u>1,150</u>
Savings	<u>\$ 86</u>	<u>\$ 56</u>	<u>\$509</u>	<u>\$ 651</u>
Percentage (note a)	9.7	30.0	70.0	36.2

a/The percentage of saving is lower than at Air Training Command bases because most of the mobile equipment and maintenance personnel will be needed for future mobility missions.

Moreover, the Strategic Air Command has 16 additional KC-135 and B-52 aircraft bases which use the same or similar mobile ground support equipment as Barksdale. Accordingly, we believe that centralized systems could significantly reduce costs at these bases.

Barksdale officials stated that the system had good potential and that not all the mobile equipment presently assigned would be needed with a centralized system. Only that equipment necessary for backup and identified as a wartime need must be retained.

Barksdale officials stated that some Strategic Air Command bases are being tasked with various mobility requirements. Officials believe that in time the mobility requirements will be increased to a level approaching the tactical forces. At that

time, most of the mobile equipment and maintenance personnel will be needed even if centralized systems are installed. Even so, the Command plans to install the systems at some of its bases.

During November 1981, Command officials informed us that they plan to install systems at Castle and Barksdale during fiscal year 1984 and also at 19 other bases by fiscal year 1989. Construction costs for the 21 installations are estimated at \$131 million. (See app. II.) Command officials believe that the centralized system will pay for themselves in 4 to 7 years. Estimated savings through fiscal year 1988 are over \$82 million, as shown below.

<u>Savings</u>	<u>FY 1984</u>	<u>FY 1985</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>Total</u>
------(millions)-----						
Fuel and maintenance	\$3.96	\$9.20	\$16.26	\$21.96	\$27.37	\$78.75
Military pay	<u>.35</u>	<u>.52</u>	<u>.71</u>	<u>.87</u>	<u>.98</u>	<u>3.43</u>
Total	<u>\$4.31</u>	<u>\$9.72</u>	<u>\$16.97</u>	<u>\$22.83</u>	<u>\$28.35</u>	<u>\$82.18</u>

#### Navy is not using centralized systems servicewide

The Navy could save at least \$7.5 million annually in operation and maintenance costs, based on data contained in a 1975 study, by installing 13 centralized systems at 11 installations. However, funding has been approved for only one of the 13 systems.

The Navy has used some form of centralized system since 1959, evolving from a simple jet engine starting system to a variety of systems. Some systems provide only jet engine starting air, others only electrical power, still others provide both services, and in some cases, a system will provide cooling air for avionics.

Between 1959 and 1976, the Navy procured 98 centralized systems, which provide only jet engine starting air. However, because of the age of some of the systems, poor design, and shortage of spare parts, only 18 are currently operating. The Navy has procured about 42 other systems that provide electric power. The Navy also has installed centralized systems that provide both jet engine starting air and electrical power at only five bases.

#### Navy studies promote installation of centralized systems

A 1975 Navy study reports that servicing aircraft with a centralized system would save \$8,280 per aircraft annually. This

is a 54-percent savings over the use of mobile support equipment. The same study documented a \$10-million decrease in the requirement for mobile equipment units when a centralized system was installed to support 166 aircraft at the Naval Air Station at Whidbey Island. The study concluded that centralized systems should be included in planning and budgeting of Navy funds in the immediate future.

A 1978 study substantiated the findings of the 1975 study. Criteria governing the 1978 study was predicated on a centralized system for a 72-aircraft unit.

After publication of the earlier study, at least 11 Navy installations requested funds to install 13 centralized systems for providing both jet engine starting air and electric power. However, before approving funding for these systems, the Chief of Naval Operations requested another validation study. This study, published in 1979, validated the conclusions of the 1975 and 1978 studies. Even though these studies cite significant savings, funding for only one of the systems has been approved.

The following table identifies the 11 Navy installations that have requested funding and the estimated annual savings that can be realized by using centralized systems instead of mobile support equipment. Two Naval Air Stations, Oceana and Cecil Field, have each requested two separate centralized systems.

<u>Naval installation</u>	<u>No. of aircraft</u>	<u>Estimated cost</u>	<u>No. of years to pay back</u>	<u>Estimated annual savings (note a)</u>
Patuxent River	64	\$ 2,128,000	3.2	\$ 665,000
Kingsville	42	1,431,000	4.2	341,000
Whidbey Island	24	1,527,000	3.5	436,000
Chase Field	42	2,004,000	4.4	456,000
Miramar	76	5,607,000	4.1	1,368,000
Meridian	30	1,194,000	4.4	271,000
Oceana	88	4,033,000	5.8	695,000
Oceana	80	3,609,000	4.1	880,000
Pensacola	24	1,278,000	4.9	261,000
Lemoore	72	4,696,000	4.5	1,044,000
Cecil Field	20	1,500,000	6.7	224,000
Cecil Field	20	1,491,000	4.6	324,000
North Island	40	3,661,000	6.6	555,000
<b>Total</b>	<b>622</b>	<b>\$34,159,000</b>		<b>\$7,520,000</b>

a/These savings were estimated on fuel prices ranging from \$0.35 to \$0.41 a gallon. During fiscal year 1980, jet fuel was \$1.27 a gallon and gasoline was \$1.29 a gallon.

The Navy has been working independently to develop a new centralized system. However, it now plans to incorporate the Air Force's rotary compressor in its system and to install the system at naval air stations where cost effective.

#### INSTALLATION COSTS CAN BE REDUCED

Installing a centralized system in conjunction with other Air Force and Navy base construction projects can save millions. The Air Force and Navy plan to spend \$164 million over the next 5 years on construction projects that will affect aircraft parking areas. The above figure includes \$86 million for parking apron renovations and \$78 million for underground refueling systems.

A centralized system uses underground lateral networks to transport services from the base stations to the aircraft servicing points on the parking aprons. Installing underground lateral networks require extensive trenching of aircraft parking aprons. This trenching process is expensive and the cost depends on the linear feet to be trenched and the depth of the parking aprons. By coordinating the installation of a centralized system with parking apron renovations and underground refueling systems, the trenching costs would be eliminated. We notified the Secretaries of the Air Force and the Navy that considerable costs could be avoided by installing centralized systems in conjunction with parking apron renovations. (See apps. IV and V.)

The Air Force said that it recognizes the benefits of centralized systems and that there are a number of bases where the systems will be installed. The Air Force also said that it does not currently intend to install the systems at tactical bases because these units must be able to deploy worldwide with mobile equipment and trained personnel to maintain it. Also, a new generator set is being acquired which will significantly reduce fuel consumption. (See app. VI.) These concerns and possible solutions are discussed further in chapter 3.

The Navy agreed that the installation should be programed and integrated with other projects relating to repair and/or replacement of aircraft parking aprons. (See app. VII.)

Appendix III identifies construction projects in the Air Force and Navy where concurrent installation of systems should be considered.

#### REQUIREMENTS FOR MOBILE EQUIPMENT WILL BE REDUCED AS CENTRALIZED SYSTEMS ARE INSTALLED

The Air Force and Navy plan to spend more than \$500 million in replacing mobile ground support equipment during fiscal years 1981 through 1986. This figure does not include the value of spare parts needed to support and maintain the mobile equipment. The services were unable to accurately isolate the total value

of spare parts earmarked for the support of the assigned mobile equipment.

Implementation of the centralized systems at all bases where feasible would preclude buying much of the above equipment and related spare parts. For example, in March 1979, the Naval Weapons Engineering Support Activity issued a report showing that the requirement for mobile equipment could be reduced by 33 percent when using centralized systems.

This report also shows that if the systems were installed at the 11 Navy installations requesting funds for the systems (see p. 16), the requirements for mobile units and tow tractors could be reduced by 215 and 160 units, respectively. The total procurement cost for these systems is about \$28.4 million and represents a potential procurement reduction for replacement mobile ground support equipment.

The Air Force has not made any studies showing the potential reduction in mobile equipment requirements that can be realized by using centralized systems. However, the Air Force Training Command estimates that it will save \$8.4 million by installing its systems at all seven of its bases, thereby eliminating the need to replace its aged mobile equipment. Other mobile equipment would have to be retained to back up the centralized systems and for deployment purposes. But, the Strategic Air Command recognizes that there will be some reduction in mobile equipment requirements by using the systems. For example, in its request for funding approval of a centralized system at Castle Air Force Base, the Command showed that 45 mobile units, valued at \$1.1 million, could be used elsewhere.

Using the centralized systems' daily operational support of aircraft should extend the life of existing mobile equipment by substantially reducing the hours of operation. The extended life of mobile equipment should further reduce or delay the procurement of replacement equipment.

Limiting the use of mobile equipment should also reduce the requirements for spare parts to maintain the equipment. Under a centralized system, the use of mobile equipment would be required for only backup support, readiness exercises, deployment purposes, and support of aircraft not serviced by centralized systems. The reduced operating hours of the mobile units would result in fewer mechanical failures, thereby reducing the requirements for spare parts.

#### CONCLUSIONS

Millions of dollars can be saved annually if the Air Force and Navy implement the centralized systems at all bases where feasible. We commend the Air Force Air Training Command for developing, installing, and using a new energy efficient system,

and the Strategic Air Command and Navy for their efforts in implementing centralized systems.

The Navy has conducted studies that demonstrate the savings attainable by using centralized systems. The Navy also has installed a first generation system at several bases. And, the Navy now plans to incorporate the Air Force's rotary compressor in its system at naval air stations where cost effective.

Some Air Force commands do not plan to install centralized systems because their tactical units need mobile equipment for deployment. These commands believe that their personnel will receive insufficient training in operating and maintaining mobile equipment if centralized systems are used. They feel that this will affect their capability to meet their deployed mission requirements. We believe, however, that with proper planning and realinement of operating procedures, these problems can be overcome and should not prevent use of centralized systems at selected bases. The concerns and possible solutions are discussed further in chapter 3.

Both services have programed funds for aircraft parking apron renovations and/or underground refueling systems. The concurrent installation of centralized systems with these projects would substantially reduce the systems' installation costs. In addition, the requirements for mobile equipment will be reduced as the systems are installed. Therefore, the requirements and planned procurements of new equipment should be reevaluated.

#### RECOMMENDATIONS

We recommend that the Secretary of Defense direct the Secretaries of the Air Force and Navy to:

- Develop a plan for installing centralized systems at air bases where they can be used cost effectively without adversely affecting mission capabilities.
- Give first priority to installing new energy efficient centralized systems in conjunction with major aircraft parking apron renovations and underground refueling systems.
- Give the next priority to those bases whose units do not need mobile equipment for deployment, that is, certain Strategic Air Command units and Navy units deploying to aircraft carriers.
- Coordinate the development of standard centralized systems and insure that all systems acquired are procured using design specifications based on a standard system or systems.

- Combine requirements to assure the most economical quantities for buying system components.
- Closely coordinate and monitor these procurements with planned procurements for mobile equipment to assure that appropriate adjustments are made to reduce or delay the latter procurements where applicable.

#### AGENCY COMMENTS AND OUR EVALUATION

Defense recognizes the significant savings in fuel, personnel, and equipment from using centralized systems. As a result, the services have initiated actions to implement the systems at those installations where economies can be achieved without jeopardizing operational and readiness requirements.

Although in general agreement, Defense expressed reservations about the recommendations dealing with base prioritization for system implementation and standardization. Defense stated that we should delete the specific reference to training bases in the base prioritization because many variables influence prioritization for system installations and other options may be preferable in some cases. We agreed and have revised the recommendation. Accordingly, the Air Force and the Navy are reviewing system applicability in conjunction with planned parking ramp renovation and construction projects. This will insure that ramp construction and system installation are done concurrently whenever possible. Moreover, other system installation will be prioritized on a case-by-case basis.

The different operation environments of Air Force, Navy, and Marine Corps aircraft units require subtle differences in their support equipment. Therefore, the Air Force is developing a standard system for its aircraft units and the Navy is developing its own systems which are similar to the Air Force's system. In addition, Defense will monitor service efforts to insure the maximum degree of system standardization consistent with operational and mission requirements. We agreed with these actions and have clarified our recommendation accordingly.

The services plan to identify their total centralized system requirements for equipment and the bases where the equipment will be installed. The object is to implement a single acquisition program with each service to meet all of their centralized system requirements. However, the ability of either service to procure these systems in economic quantities will be constrained by the requirement to have them available for installation as military construction projects are funded and executed.

The services have consolidated primary responsibility for the centralized system and mobile equipment requirements, development, and procurements within the same offices. These offices will insure that, wherever possible, mobile equipment acquisitions are reduced based on planned centralized system acquisitions. (See app. VIII.)

### CHAPTER 3

#### AIR FORCE CONCERNS REGARDING CENTRALIZED

#### SYSTEMS FOR TACTICAL UNITS AND POSSIBLE SOLUTIONS

The Air Force recognizes the benefits that centralized systems can provide through reducing fuel, equipment, and personnel requirements. Each command has been asked to analyze its bases to determine if centralized systems should be installed. Although a final decision has not been reached, systems will be installed at a number of bases. The Air Force also informed us that it does not intend to install centralized systems at any of its tactical bases because these units must be able to deploy worldwide with their mobile equipment and trained personnel to maintain it. Also, a new generator set is being acquired which will significantly reduce fuel consumption.

While these concerns are valid, we believe that with proper planning and realignment of operating procedures, tactical bases can use centralized systems to support most of their daily operations, maintain their mobile equipment, and have trained personnel for deployment.

#### AIR FORCE REALIZES CENTRALIZED SYSTEMS ARE COST EFFECTIVE

The Air Force realizes that its centralized system can reduce fuel, equipment, and personnel requirements. Accordingly, it asked its major commands to analyze each base to determine if its system should be installed. While some commands have done this, others have not. Some commands did not consider using the system because their tactical units will need mobile equipment when they deploy during wartime.

On October 29, 1980, the Air Force asked its major commands to advise its Air Training Command of their intention to implement its centralized system and to project the savings that could be realized. Only two replies were received and they both stated that they had no intention of using the system.

Because of the poor response on January 8, 1981, the Air Force requested that each command provide a detailed analysis, by base, showing the advantages and disadvantages of installing the system. Six commands responded to this request. All the responses, except the Strategic Air Command, were negative. Moreover, some commands rejected the system without an adequate evaluation.

#### The centralized system rejected without adequate evaluation

The Tactical Air Command and the Military Airlift Command have expressed major concerns about using the centralized system



because many of their units are scheduled to deploy overseas during wartime. Neither command made an analysis of its bases to see if the system could be installed, as the Air Force requested. As a result, the Tactical Air Command overlooked its T-38 aircraft training base, and the Military Airlift Command did not consider its C-5 and C-141 aircraft bases, whose units generally do not have deployment missions.

Tactical Air Command officials agree that Holloman Air Force Base, Alamogordo, New Mexico, could use the system. They also agreed that a feasibility study would not be necessary since the Air Training Command has proven that the system is cost effective in supporting the T-38 aircraft at Randolph Air Force Base. Moreover, Military Airlift Command officials agree that C-5 and C-141 aircraft bases could use the electrical portion of the system to support these aircraft.

#### SPECIFIC CONCERNS AND POSSIBLE SOLUTIONS

On April 22, 1981, the Air Force informed us that it did not intend to use the centralized system at any of its tactical bases because:

"a. Tactical units are deployable and must be able to deploy worldwide with mobile equipment. Therefore, there will be no appreciable equipment savings.

"b. Maintenance technicians must be thoroughly trained and experienced on mobile equipment and therefore must operate and maintain it on a daily basis to maintain proficiency. High technician turnover further compounds this problem.

"c. A new generator set (AM32A-85) is being acquired which will significantly reduce fuel consumption. Therefore, projected savings will be lower." (See app. VI.)

While these concerns are valid, we believe that with proper planning and realignment of operating procedures, tactical bases can use the centralized system to support most of their daily operations and also maintain their mobile equipment and trained personnel for deployment. The following sections discuss the above concerns and possible solutions.

#### Mobile equipment is needed for deployment

Air Force tactical units need their mobile equipment for deployment overseas during wartime. Accordingly, there will be no appreciable equipment savings if the system is installed at these bases. Since most savings are the result of reduced operating costs, savings from equipment reductions should not be a major concern.

For example, we reviewed the method and costs of providing aircraft ground support services to the 42 RF-4 aircraft assigned at Bergstrom Air Force Base. Support service is provided by 78 units of mobile equipment. Our analysis shows that annual savings of about \$276,000 could be realized by using the centralized system installed at Randolph.

Our analysis did not consider any reduction in mobile equipment, since Bergstrom would need to retain it for its deployment mission. Moreover, Bergstrom is scheduled to receive 40 more RF-4 aircraft and Air Force officials agree that with the additional aircraft the annual estimated savings would be \$552,000. Furthermore, the Tactical Air Command has six additional F/RF-4 aircraft bases which use the same or similar mobile equipment as Bergstrom. Therefore, we believe that the system could significantly reduce costs at these bases, while allowing them to keep all of the mobile equipment needed for deployment.

Mobile equipment must be operated  
and maintained daily

According to the Air Force, maintenance personnel must be thoroughly trained and experienced on mobile equipment. Therefore, personnel must operate and maintain the equipment daily to remain proficient. A high turnover rate of these personnel further compounds this problem. We agree that personnel must be adequately trained to operate and maintain mobile equipment, but we do not believe the training has to be daily.

For example, mobile equipment can be assigned to a squadron of aircraft at each base for daily use. The remaining equipment can be stored. Periodically, the equipment can be rotated in and out of storage and reassigned to a different squadron. This would allow each base to operate all of its mobile equipment periodically while providing the necessary training and experience for maintenance personnel. Accordingly, the centralized system could be used daily to support the remaining squadrons' aircraft, thereby significantly reducing fuel consumption and saving millions of dollars without affecting deployment capabilities.

New mobile equipment will significantly  
reduce fuel consumption

The Air Force also informed us that it is acquiring a new generator set (AM32A-85), which will significantly reduce fuel consumption. According to its Systems Command, this generator set is still in the design stage and probably will not be available for use until fiscal year 1987. While it is believed that the new generator set will be more fuel efficient than the model it is to replace, a Systems Command official informed us that it does not know what the fuel consumption will be. Moreover, the generator set is estimated to cost \$65,000: \$45.5 to \$52 million just for 700 to 800 sets for the Tactical Air Command.

## CONCLUSIONS

The Air Force recognizes that centralized systems are cost effective and plans to install systems at many of its bases. However, it does not plan to install the systems at any tactical bases because these units must have trained personnel to deploy worldwide with their mobile equipment. Also, a new generator set is being acquired which the Air Force says will significantly reduce fuel consumption.

While these concerns are valid, we believe that with proper planning and realinement of operating procedures, tactical bases can use centralized systems to support most of their daily operations, maintain their mobile equipment, and have trained personnel for deployment. At the same time, fuel consumption can be reduced significantly and millions of dollars can be saved.

The generator set being acquired is still in the design stage, its fuel consumption is unknown, and it probably will not be available for use before fiscal year 1987. Therefore, it may not be cost effective to acquire the new generator set due to its high price and the large quantities needed to replace the older sets in the tactical units.

## RECOMMENDATIONS

We recommend that the Secretary of the Air Force:

- Reevaluate the decision not to install centralized systems at tactical bases. If the Secretary decides that the systems can be used at these bases without adversely affecting the units' deployment missions, first priority should be given to installing the system at those tactical bases undergoing parking apron renovations. (See app. III.)
- Assess the requirement for the new generator set along with other mobile equipment, as recommended on page 20.

## AGENCY COMMENTS AND OUR EVALUATION

DOD agreed that centralized systems should be installed wherever their use does not detract from units' ability to maintain combat readiness and operational proficiency. However, the Air Force has reevaluated the use of the systems by tactical units and remains reluctant to install them where such installation would force a unit to operate differently in peacetime than it must in wartime. A tactical unit, which operates using a centralized system during peacetime would be unable to make a transition quickly and smoothly to mobile equipment while maintaining full combat readiness in a contingency. When support personnel do not use mobile equipment on a daily basis, their proficiency in handling, servicing, controlling, maintaining,

and managing it will deteriorate to a point where they may not be able to provide effective support when forced to make the transition back to mobile equipment under an increased operating tempo.

The Air Force is exploring the possibility of conducting some tests, using actual combat units, to evaluate the validity of the above concerns. However, until the test results are assessed, the Air Force does not plan to convert tactical units to centralized operation. Defense supports the Air Force's position and will continue to monitor action in that regard. We strongly support the Air Force conducting such tests to evaluate the validity of the concerns regarding the installation of centralized systems at tactical bases. Accordingly, we believe that the Secretary's response to our recommendation should be based on the results of such tests.

The Air Force has discussed at length the impact of large scale implementation of centralized systems on the ground powered generator program. The new generator is being developed as a fuel efficient replacement for the existing gas turbine generator and air-conditioner, which are used primarily by tactical forces. The gas turbine generator consumes 45 gallons of fuel per hour. The new generator, based on estimates from potential contractors, will consume no more than 15 gallons of fuel per hour.

Based on these factors, the Air Force has concluded that the new generator is justified. Therefore, it has determined that since the tactical forces will require the same amount of mobile equipment for deployment regardless of whether or not the systems are installed, no reductions in the quantity of generators to be acquired will result from the installation of the systems. Defense supports the Air Force's position.

The Air Force is justifying the new generator for tactical units without considering the significant quantities of mobile equipment that will become excess to the needs of nontactical units as centralized systems are installed. Therefore, we believe that the Air Force should evaluate the impact of this additional equipment on the requirement for the new generator. Especially since the new generator has not yet been designed and, therefore, may not be as fuel efficient as potential contractors estimate. In our opinion, once this evaluation has been made, the new generator should be procured only if it is either cost effective or mission essential. (See app. VIII.)

MOBILE AIRCRAFT GROUND SUPPORTEQUIPMENT ASSIGNED AT FOURAIR FORCE BASES

This appendix identifies the type and quantities of aircraft mobile ground support equipment used by Bergstrom, Barksdale, and Little Rock Air Force Bases in the United States and Torrejon Air Base in Spain.

<u>Item/services provided</u>	<u>Bergstrom</u>	<u>Little Rock</u>	<u>Barksdale</u>	<u>Torrejon</u>
<u>JET-START COMPRESSOR</u>				
Compressed air for jet engine starting	0	9	4	3
<u>GENERATOR (gasoline/diesel)</u>				
Power for aircraft electrical systems	0	57	31	14
<u>JET-START GENERATOR</u>				
Compressed air for jet engine starting and power for aircraft electrical systems	18	0	22	37
<u>TRACTORS/TOW TUGS</u>				
Transports the mobile equipment to aircraft	7	7	9	8
<u>FLOODLIGHT SETS</u>				
Area illumination and a source for household current	13	16	32	53
<u>CABIN PRESSURE TESTERS</u>				
Tests aircraft cabin pressurization system	3	0	0	2
<u>HYDRAULIC TEST STANDS</u>				
Power source for testing aircraft hydraulic systems	8	3	4	11

## APPENDIX I

## APPENDIX I

<u>Item/services provided</u>	<u>Bergstrom</u>	<u>Little Rock</u>	<u>Barksdale</u>	<u>Torrejon</u>
<u>AIR-CONDITIONERS</u>				
Cooling air for aircraft cabin and electronics system	6	5	25	11
<u>HEATERS</u>				
Warm air for aircraft cabin and electronics systems	11	44	20	38
<u>AIR COMPRESSORS (high/low)</u>				
Low pressure air for pneumatic tools and high pressure air for aircraft tires and landing struts	<u>12</u>	<u>24</u>	<u>18</u>	<u>41</u>
Total	<u>78</u>	<u>165</u>	<u>165</u>	<u>218</u>

PROJECTED SYSTEM INSTALLATION COST FOR  
21 STRATEGIC AIR COMMAND BASES

Projected installation costs

(millions)

Fiscal year 1984:

Castle AFB	\$ 9.72
Barksdale AFB	11.58
K. I. Sawyer AFB	<u>5.76</u>
	<u>27.06</u>

Fiscal year 1985:

Ellsworth AFB	5.95
Minot AFB	5.70
Mather AFB	4.25
Wurtsmith AFB	5.30
Dyess AFB	<u>4.77</u>
	<u>25.97</u>

Fiscal year 1986:

Grand Forks AFB	6.10
Fairchild AFB	6.92
Blytheville AFB	4.59
Pease AFB	8.29
Carswell AFB	<u>5.41</u>
	<u>31.31</u>

Fiscal year 1987:

Robins AFB	5.84
Griffiss AFB	4.69
Plattsburgh AFB	9.59
Grissom AFB	<u>5.41</u>
	<u>25.53</u>

Fiscal year 1988:

March AFB	5.07
Beale AFB	8.10
Loring AFB	5.37
Offutt AFB	<u>2.50</u>
	<u>21.04</u>

Total

\$130.91

## APPENDIX III

## APPENDIX III

AIR FORCE AND NAVY MAJOR CONSTRUCTION PROJECTS(Fiscal years 1981 - 1987)AIR FORCE

	<u>Expense</u>		<u>Total</u>
	<u>Parking apron</u>	<u>Refueling system</u>	<u>cost</u>
----- (000 omitted) -----			
Military Airlift Command:			
McGuire	\$10,800	\$8,000	\$18,800
Strategic Air Command:			
Carswell	6,100	-	6,100
Fairchild	17,000	-	17,000
Grissom	5,061	8,196	13,257
Loring	4,216	-	4,216
Barksdale	-	9,000	9,000
Malmstrom	-	9,747	9,747
McConnell	-	6,489	6,489
Peterson	-	7,295	7,295
March	-	11,500	11,500
Whiteman	-	6,957	6,957
MX Missile (2 sites)	-	10,450	10,450
Total	32,377	69,634	102,011
Tactical Air Command (note a):			
Bergstrom	12,248	-	12,248
Seymour-Johnson	6,181	-	6,181
Homestead	2,255	-	2,255
Shaw	7,763	-	7,763
Luke	642	-	642
Holloman	743	-	743
Total	29,832		29,832
Total			
19 Bases	73,009	77,634	150,643



## APPENDIX III

## APPENDIX III

NAVY

	<u>Expense</u>		<u>Total</u>
	<u>Parking apron</u>	<u>Refueling system</u>	<u>cost</u>
----- (000 omitted) -----			
Naval Air Station (note b):			
Jacksonville	1,082	-	1,082
Norfolk	1,519	-	1,519
Barbers Point	1,867	-	1,867
Alameda	2,131	-	2,131
Fallon	2,410	-	2,410
Whidbey	1,445	-	1,445
Rep. of Puerto	<u>2,417</u>	-	<u>2,417</u>
Total			
7 Bases	<u>12,871</u>	-	<u>12,871</u>
Total Air Force and Navy			
26 Bases:	<u>\$85,880</u>	<u>\$77,634</u>	<u>\$163,514</u>

a/Centralized systems should not be considered for installation at these bases unless the Air Force determines that it will not adversely affect the deployment mission of its tactical aircraft units.

b/Navy projects are for fiscal years 1981-82 only.



UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,  
AND READINESS DIVISION

March 9, 1981

The Honorable Verne Orr  
The Secretary of the Air Force

Dear Mr. Secretary:

The U.S. General Accounting Office is currently reviewing the management of aircraft ground support equipment in the custody of using units (assignment code 943083). During the course of this review, we have identified matters which we believe warrant your immediate attention. These matters are detailed below.

BACKGROUND

One of the objectives of our review is to determine the feasibility of expanding the use of a relatively new cost/fuel saving concept for providing ground support to aircraft in lieu of mobile powered equipment which is costly to maintain and operate. This new concept, called the centralized aircraft support system is currently being installed by the Air Force Air Training Command. The system consists of a base station which supplies pressured air and electric power to numerous stationary aircraft service points through underground piping and electrical conduit.

The system virtually eliminates the need for gasoline, JP 4/5, and diesel powered mobile ground support equipment except for back-up and deployment purposes. The system uses commercially procured electric power resulting in significant savings of petroleum products. Further, the system is less costly to maintain and requires fewer personnel to operate.

The Air Training Command estimates a total net savings of about \$76 million over the 25-year life of the new system to be installed at its seven pilot training bases, compared to the cost of procuring, operating, and maintaining mobile ground support equipment. The payback period has been estimated at 3.6 years.

Our audit work at Bergstrom Air Force Base, Austin, Texas, indicates that the centralized aircraft support system would be a very cost/fuel efficient system to install

in lieu of the continued daily use of powered mobile support equipment. Bergstrom has two squadrons of RF-4 aircraft and is scheduled to receive two additional RF-4 squadrons from Shaw Air Force Base. Consequently the cost/fuel savings will be even greater if the new system is used to support all four squadrons.

#### MATTERS FOR CONSIDERATION

Bergstrom Air Force Base has received Headquarters, USAF, approval to replace its aircraft parking apron. Construction is scheduled to begin within the next 6 months. This project, estimated at \$12 million, requires completely removing the concrete to the subsoil base, repacking the subsoil, and reconcreting the entire area. We understand that other Air Force bases may have received approval or are scheduled to also replace aircraft parking aprons.

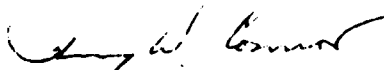
Before renovations of aircraft parking aprons are approved, serious consideration should be given to installing a centralized aircraft support system at the same time. Installing a centralized system in conjunction with renovating an aircraft parking apron will result in savings of about \$280,000 in the costs associated with installing such a system.

We believe the Air Training Command has made considerable progress in developing and implementing a very efficient and effective centralized aircraft support system for providing ground support to its aircraft. Further, we believe this system can be adapted for other major command Air Force bases. Considerable savings in installing a centralized system can be realized at those bases scheduled for parking apron renovation if the installation and construction of these projects are closely coordinated.

We would appreciate having your comments regarding the matters discussed in this letter. We are available to meet with you or your representatives at your convenience.

We also wish to acknowledge the cooperation and courtesies extended to our representatives during this ongoing review.

Sincerely yours,

  
Henry W. Connor  
Associate Director



UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

PROCUREMENT, LOGISTICS,  
AND READINESS DIVISION

MAY 5 1981

The Honorable John H. Lehman, Jr.  
The Secretary of the Navy

Dear Mr. Secretary:

The U.S. General Accounting Office is currently reviewing the management of aircraft ground support equipment in the custody of using units (assignment code 943083). During the course of this review, we have identified matters which we believe warrant your immediate attention. These matters are detailed below:

BACKGROUND

One of the objectives of our review is to determine the feasibility of expanding the use of a relatively new cost/fuel saving concept for providing ground support to aircraft in lieu of mobile powered equipment. The Central Aircraft Support System (CASS) consists of a base station with electric powered air compressors and generators which supply air and electric power to numerous stationary aircraft service points through underground piping and electrical conduit.

The CASS virtually eliminates the need for gasoline, JP 4/5, and diesel powered mobile ground support equipment except for backup and deployment purposes. It uses commercially procured electric power resulting in significant savings of petroleum products. Further, the system substantially reduces the requirement for personnel to operate and maintain the equipment.

The CASS also uses a state-of-the-art "rotary-screw" mechanism that provides pressured air on demand to numerous aircraft. This eliminates the need for storage tanks that tend to lose pressure and require several hours to refill once the air has been depleted.

Randolph Air Force Base, a training facility, has implemented this CASS with very positive results. The Air Training Command estimates a total net savings of \$76 million over the

25-year life of the system to be installed at all seven of its pilot training bases. The payback period has been estimated at 3.6 years.

The Navy has been considering a similar system that, while lacking the rotary-screw feature, would result in some savings. In 1977 the Naval Facilities and Engineering Command contracted the Burns-McDonnell consulting firm (contract #N000-25-77-C-000) to determine the feasibility of this fixed point system and to develop a general design application. The study was released in September 1978 and concluded a net savings of about \$7.68 million would be realized over the 25-year life of the new system at each NAS where it is installed. The design assumes the capability to meet the simultaneous demands of 18 aircraft. The system will still result in a payback period of 2.4 years. It also should be noted that this study underestimated the high increases in the cost of petroleum during recent years which would improve even further the cost effectiveness of the system.

As a result of this study and a previous Naval Air Engineering Center review (NAEC-GSED-86, July 1975), the Chief of Naval Operations requested verification of the findings. A subsequent report prepared by the Naval Weapons Engineering Support Activity (Report No. 2-79, March 1979) validated these conclusions and identified 13 projects pending approval of MILCOM funding. However, none of these have been approved to date.

#### MATTERS FOR CONSIDERATION

We believe future CASS should be designed using the rotary-screw feature. This has been demonstrated to be a more efficient system than others currently in use.

Before renovations of aircraft parking aprons are undertaken, serious consideration should be given to installing a fixed point CASS in conjunction with the repairs. We found this will result in savings of about \$280,000 in the costs of installing such a system at Bergstrom AFB, Austin, Texas.

For this reason we believe immediate consideration should be given to installing this system at all Naval Air Stations where it is cost effective, particularly at the following installations scheduled for repair and/or replacement of parking aprons during FY 81 and 82.

## APPENDIX V

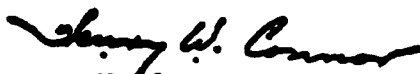
## APPENDIX V

<u>Station</u>	<u>FY</u>	<u>Estimated Cost (000)</u>
NAS NORVA	81	\$1,519
NAS BARPT	81	865
NAS NORIS	81	345
NAS AGAMA	81	510
NAS Alameda	81	340
NAS Bermuda	81	386
NAS Fallon	82	1,197
NAS Alameda	82	1,791
NAS Whidbey	82	1,945
NAVSTA RPR	82	2,417
NAS BARPT	82	620
NAS BARPT	82	382
NAS ANNA	82	275
NAS Whiting Fld	82	<u>305</u>
Total		\$12,897

We would appreciate having your comments regarding this matter. We are available to meet with you or your representatives at your convenience.

We also wish to acknowledge the cooperation extended to our representatives during this ongoing review.

Sincerely yours,



Henry W. Connor  
Associate Director

DEPARTMENT OF THE AIR FORCE  
WASHINGTON 20330

OFFICE OF THE ASSISTANT SECRETARY

22 APR 1981

Mr. Henry W. Connor  
Associate Director, Procurement,  
Logistics and Readiness Division  
U.S. General Accounting Office  
441 G Street, N.W.  
Washington DC 20548

Dear Mr. Connor

This is in reply to your March 9, 1981 letter to the Secretary of the Air Force regarding the implementation of a centralized aircraft support system (CASS) at Bergstrom AFB, Austin, Texas. CASS implementation surfaced as part of your review of the management of aircraft ground support equipment in the custody of using units, OSD Case #5661, GAO Code 943083.

The Air Force recognizes the benefits that CASS type systems can provide through reduced fuel, equipment and manpower requirements. The major commands have each been asked to review those situations where CASS implementation makes sense. Although answers are not definitive, there are a number of bases other than at Randolph AFB where a CASS system will be implemented.

With respect to Bergstrom AFB and other tactical units, both state-side and abroad, the Air Force does not currently intend to implement CASS systems. The rationale supporting this is as follows:

a. Tactical units are deployable and must be able to deploy worldwide with mobile equipment. Therefore, there will be no appreciable equipment savings.

b. Maintenance technicians must be thoroughly trained and experienced on mobile equipment and therefore must operate and maintain it on a daily basis to maintain proficiency. High technician turnover further compounds this problem.

c. A new generator set (AM32A-85) is being acquired which will significantly reduce fuel consumption. Therefore, projected savings will be lower.

Based on the above points, the Air Force does not intend to install a CASS at Bergstrom AFB.

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APPENDIX VI

Again let me reiterate that we fully support the CASS concept and are taking a number of steps to insure wider implementation. We will carefully review each opportunity for equipment, fuel and manpower savings. Thank you for calling this particular situation to our attention.

Sincerely,

A handwritten signature in dark ink, appearing to read 'L. K. Mosemann II', with a stylized flourish at the end.

L. K. MOSEMAN II  
Deputy Assistant Secretary  
(Logistics)



APPENDIX VII

APPENDIX VII



DEPARTMENT OF THE NAVY  
OFFICE OF THE SECRETARY  
WASHINGTON D C 20350

9 JUN 1981

Mr. Henry W. Connor  
Associate Director  
Procurement, Logistics, and Readiness Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Connor:

This is in reply to your letter of May 5, 1981 to the Secretary of the Navy regarding "Management of Air Force and Navy Aircraft Ground Support Equipment in the Custody of Using Units" (GAO Code 943083).

The general conclusions drawn in GAO's letter to SECNAV are understood to be as follows:

- That a fixed aircraft servicing system is an adequate means of servicing naval aircraft and would afford the Navy considerable savings in funds, fuel and manpower;
- that the Fixed Point Utility Support (FPUS) system design should be similar to the Central Aircraft Support System (CASS) installed at Randolph Air Force Base;
- that a FPUS system would effect more savings if installed in conjunction with repair and/or replacement of aircraft parking aprons; and
- that immediate consideration should be given to installing FPUS systems at naval air stations where it would be cost effective.

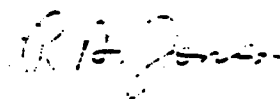
The following Navy comments are provided in response to the above conclusions:

- NAEC-GSED-86 study of July 1975 identified FPUS as a viable means of servicing naval aircraft and discussed many savings that would result from implementing the study findings.
- FPUS system design criteria were developed by the Burns-McDonnell consulting firm for NAVFACENGCOM in 1977. This design is essentially complete, but the final specification and drawings have not yet been

issued. The design includes 60/400 Hz electrical servicing and compressed air for aircraft starting and appears to be the same as the CASS with the exception of the rotary-screw feature (the CASS design was based on the Navy effort). NAVFACENGCOM design criteria can and should be updated to incorporate a rotary-screw feature.

- FPUS system should be programmed and integrated with other facility projects relating to repair and/or replacement of aircraft parking aprons. This can easily be done since each FPUS installation would have to be tailored to suit the mission of an individual air station.
- Every effort is being made within budgetary constraints and fleet prioritization considerations to retrofit FPUS systems at naval air stations where it is cost effective to do so. Additionally, where new construction is being built, e.g., F/A-18 ramps, LAMPS MK III pads, FPUS systems are being installed.

Sincerely,



**R.A. JONES**  
**CAPT, SC, USN**

**PRINCIPAL ASSISTANT FOR LOGISTICS**



MANPOWER,  
RESERVE AFFAIRS  
AND LOGISTICS

## ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

23 FEB 1982

Mr. Donald J. Horan  
Director, Procurement, Logistics  
and Readiness Division  
U.S. General Accounting Office  
441 G Street, N.W.  
Washington, D.C. 20548

Dear Mr. Horan:

This is in reply to your January 4, 1982 letter to the Secretary of Defense regarding a GAO draft report entitled, "DoD Can Save Millions By Using Energy Efficient Centralized Aircraft Support Systems," Code 943083 (OSD Case #5661-A).

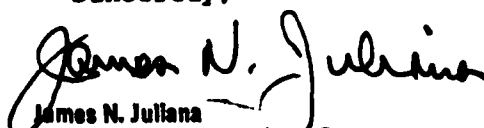
We agree that Centralized Aircraft Support Systems (CASS) can provide significant savings in terms of reduced requirements for fuel, manpower and equipment. Savings where CASS systems have been installed or improved are reflected in the DoD budget. However, it will take several years before wider implementation occurs and the full potential of savings can be realized. The Services have initiated actions to expand CASS implementation to include those installations where economies can be achieved without jeopardizing operational and readiness requirements.

Although we generally agree with the draft report, we have reservations about several of the recommendations. Of primary concern are the recommendations dealing with standardization and with base prioritization for CASS implementation. We agree with the Air Force that CASS type systems may be impractical for tactical units with deployment commitments, and that a new ground generator is still needed to achieve improved fuel efficiency over present units. Specific responses for each recommendation are attached.

We appreciate the GAO efforts in addressing the benefits of CASS type systems. The report will be useful in our continuing efforts to achieve cost savings without degrading combat readiness or operational proficiency.

Sincerely,

Attachment

  
James N. Juliana  
Principal Deputy Assistant  
Secretary of Defense  
(Manpower, Reserve Affairs, and Logistics)

## COMMENTS ON DRAFT GAO REPORT

"DoD Can Save Millions By Using Energy Efficient Centralized Aircraft Support Systems" GAO Code 943083 (OSD Case #5661-A)

Recommendation 1:

-- Develop a plan for installing CASS at those air bases where it can be used cost effectively without adversely affecting mission capabilities.

Comment: Concur. The Air Force and Navy are reviewing their installations/bases for the applicability of CASS.

Recommendation 2:

-- Give first priority to installing CASS in conjunction with major aircraft parking apron renovations and underground refueling systems.

Comment: Concur. The Air Force is developing a procedure to review CASS applicability in conjunction with planned parking ramp renovation/construction projects. The procedure will insure that ramp construction and CASS installation are done concurrently wherever possible. The Navy has a similar procedure.

Recommendation 3:

-- Give the next priority to training bases and to those bases whose units do not need mobile equipment for deployment, e.g., certain SAC units and Navy units deploying to aircraft carriers.

Comment: Concur in principle. However, base prioritization for CASS installation must be a DoD decision on a case by case basis. Many variables influence prioritization for CASS installations and other options may be preferable in some cases.

Therefore, the specific reference to training bases should be eliminated from this recommendation in the final report.

Recommendation 4:

-- Coordinate the development of standard CASS and insure that all systems acquired are procured using design specifications based on the standard system or systems.

Comment: Concur in principle. The different operating environments of Air Force and Navy/Marine Corps units dictate subtle differences in their support equipment. Caution must be exercised to insure that standardization of the CASS does not negate compatibility with the diverse

operating environments and the units utilizing the equipment. The Air Force has drafted a Statement of Operational Need (SON) for a standard CASS for Air Force units. The SON is currently in the coordination/validation phase and will be entered into the POM process as appropriate. The Navy is developing a similar process for effecting CASS standardization within the Navy. OSD will monitor Service efforts to insure the maximum degree of CASS standardization consistent with operational and mission requirements.

Recommendation 5:

-- Combine requirements to assure the most economical quantities for buying system components.

Comment: Concur. The Air Force plans to issue a Program Management Directive (PMD), based on the above SON, which will identify total numerical requirements in terms of quantities of equipment and bases where that equipment will be installed. The objective is to implement a single acquisition program to meet all Air Force needs. The Navy has a similar effort. In the final analysis, the ability of either Service to procure these systems in economic quantities will be constrained by the requirement to have them available for installation as MILCON projects are funded and executed.

Recommendation 6:

-- Closely coordinate and monitor these procurements with planned procurements for mobile equipment to assure that appropriate adjustments are made to reduce or delay the latter procurements where applicable.

Comment: Concur. The Services have consolidated primary responsibility for CASS and mobile equipment procurements, developments and acquisitions within the same offices. These offices will insure that, wherever possible, mobile equipment acquisitions are curtailed based on planned CASS acquisitions.

Recommendation 7:

-- Reevaluate the decision not to install CASS at tactical bases. If the Secretary decides that CASS can be used at these bases without adversely affecting the units' deployment missions, first priority should be given to those tactical bases undergoing parking apron renovations, as shown in Appendix VII.

Comment: Concur in principle. We agree that CASS should be installed wherever its use by the assigned unit does not detract from the ability to maintain combat readiness and

operational proficiency. However, the Air Force has reevaluated the use of CASS by tactical units and remains reluctant to install CASS where such installation would force a unit to operate differently in peacetime than it must in war. A tactical unit which operates using CASS during peacetime would be unable to transition quickly and smoothly to mobile equipment while maintaining full combat readiness in a contingency. When support personnel do not use mobile equipment on a daily basis, their proficiency in handling, servicing, controlling, maintaining, and managing it will deteriorate to a point where they may not be able to provide effective support when forced to transition back to mobile equipment under an increased operating tempo.

The report states that because CASS requires much less manpower for operation and maintenance than does mobile equipment, installation of CASS would permit significant reductions in manpower authorizations. This is correct. However, if tactical unit manning is reduced, the units thus affected will be unable to meet their wartime tasking because the numbers of people required to operate their mobile equipment will simply not be available. The proposed GAO solution to this problem is periodic rotation of tactical units into a mobile equipment support mode. Air Force experience indicates that it is not practical. The process of moving tactical squadrons onto and off of a CASS equipped ramp on a periodic basis would be extraordinarily cumbersome and time consuming, and would detract from their primary missions. The constant relocation and reorganization of administrative and other support resources necessitated by such transitions would create disruption and consume combat training time. Additionally, if it became necessary to taxi any aircraft, the fuel savings of CASS would likely be negated.

The Air Force is exploring the possibility of conducting some tests, using actual combat units, to evaluate the validity of the above concerns. However, until the test results are assessed, the Air Force does not plan to convert tactical units to CASS operation. We support their position and will continue to monitor their action in that regard.

Recommendation 8:

-- Assess the requirement for the new generator set, along with other mobile equipment as recommended above. (See p. 33.)

Comment: Concur in principle. The Air Force has discussed at length the impact of large scale implementation of CASS on the ground powered generator (GPG) program. The GPG is being developed as a fuel efficient replacement for the existing A/M32A-60A gas turbine generator and A/M32C-10 air conditioner, which are used primarily by our tactical

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APPENDIX VIII

forces. The A/M32A-60A consumes 45 gallons per hour of JP-4; the GPG, based on estimates from potential contractors, will consume no more than 15 gallons per hour. Based on those factors, the Air Force has concluded that the GPG program is justified, and has determined that since the tactical forces will require the same amount of mobile equipment for deployment regardless of whether or not CASS is installed, no reductions in the quantity of GPGs to be acquired will result from the installation of CASS. We support the Air Force's position regarding this recommendation.

(940001)